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First Named Inventor	Frank JANSEN
Art Unit	1762
Examiner Name	Howard E. Abramowitz
Attorney Docket Number	M02A430
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ENCLOSURES *(Check all that apply)*

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  - [ ] Fee Attached
- [ ] Amendment/Reply
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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	The BOC Group, Inc.		
Signature	David A. Hey		
Printed name	David A. Hey		
Date	February 24, 2006	Reg. No.	32,351

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Signature	Kimberly S. Brown		
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Of:	Frank JANSEN
Serial No:	10/712,495
Filed:	13 November 2003
For:	Atomic Layer Deposition Process and Apparatus
Confirmation No.:	8327
Art Unit:	1762
Examiner:	Abramowitz, Howard E.
BOC Case No:	M02A430

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24 February 2006

APPEAL BRIEF

Dear Sir:

The following Appeal Brief is respectfully submitted in connection with the above identified application in response to the Advisory Action dated 19 January 2006, maintaining the rejection of claims 1-20 as set forth in the Final Office Action dated 8 November 2005.

Table of Contents

Real Party in Interest

The real party in interest for the above identified application are the inventors, and the assignee of the invention, The BOC Group, Inc.

Related Appeals and Interferences

There are no related appeals or interferences known to any of the appellant, the undersigned or the assignee which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-20 remain pending. Claims 1-10 have been withdrawn from consideration based on a restriction requirement. The final rejection of claims 11-20 is hereby appealed.

Status of Amendments

There are no amendments that have not been entered in the present application.

Summary of Claimed Subject Matter

The present invention is directed to a method of ALD deposition wherein the precursor gases flow into the reactor chamber from an auxiliary chamber solely due to a pressure gradient between the two chambers. This method reduces the use of excess precursor gas and ensures the spatial uniformity of layers produced by the ALD process.

As noted in the specification of the instant application, the present invention overcomes several disadvantages of prior art ALD processes that rely on gas being delivered through a flow line to the deposition chamber. In particular, pressure naturally varies over a flow line making uniform deposition impossible. To overcome these pressure variations, prior art ALD processes have utilized flow controllers to better control the flow rate through the flow lines. However, such flow controllers have relatively slow reaction times with the result that flow rates must be set at a constant rate. This leads to significant waste of gas.

The present invention overcomes all of these disadvantages by providing a method of delivering precursor gases that specifically allows each precursor gas to flow from an auxiliary chamber to the reactor chamber solely under a gradient pressure.

Grounds of Rejection to be Reviewed

Whether claims 11-17 are properly rejected under 35 USC 102(e) as being anticipated by Sneh (US Patent Application Publication 2003/180458).

Whether claims 18-19 are properly rejected under 35 USC 103(a) as being unpatentable over Satta et al (US Patent No. 6,391,785) in view of Sneh.

Whether claim 20 is properly rejected under 35 USC 103(a) as being unpatentable over Sneh as applied to claims 11-17, and further in view of Kang et al (US Patent No. 6,287,965).

Argument

Whether claims 11-17 are properly rejected under 35 USC 102(e) as being anticipated by Sneh (US Patent Application Publication 2003/180458).

Claims 11-17 are rejected under 35 USC 102(e) as being anticipated by Sneh, wherein the Examiner indicates that Sneh discloses a method of delivering precursor gasses for an ALD process that utilizes separate booster chambers for each chemical reactant, and valves for admitting the reactants to a reaction chamber. In the Final Office Action of 8 November 2005, the Examiner states that the process of Sneh "is run solely under a pressure gradient" citing paragraphs 38 and 89. The Examiner also points to other sections of Sneh as teaching various aspects of the dependent claims of the present invention.

Further, in the Final Office Action, the Examiner provided an esoteric discussion of what he believes "gradient pressure" to mean, including references to electrophoresis and temperature driven flows. However, this discussion does not alter the basic fact that Sneh clearly fails to teach or suggest the present invention as will be discussed in more detail below.

The rejections of claims 11-17 are respectfully traversed and it is respectfully submitted that the present invention is patentably distinct from Sneh. Contrary to the Examiner's allegations, Sneh does not teach or suggest an ALD method wherein precursor gas flows from auxiliary chambers to an inlet of the process chamber solely under a pressure gradient as required by the present invention, (see claim 11). Rather, Sneh requires a complex "Synchronous Modulation of Flow and Draw (SMFD)" process to achieve 1) short reaction times with good chemical utilization, and 2) minimum purge gas and chemical removal times while preventing backflow (See Sneh paragraph 22). In fact, the Sneh paragraphs cited by the Examiner as supporting pressure gradient flow, actually teach away from such a

process. Paragraph 38 of Sneh clearly states that the first chemical reactant is provided to the deposition chamber by "flowing a first chemical reactant gas at a selected first-dosage flow rate and at an independently selected first-dosage pressure" comprising "controlling the first-dosage flow rate of the first chemical reactant gas into the deposition chamber and independently substantially matching a first-chemical draw of the first chemical reactant gas out of the deposition chamber". Further, paragraph 89 of Sneh states that the flow of "chemically reactive gas into deposition chamber 114 conforms to an initial pulse that gradually decreases to the steady-state flow" with a concurrent draw pressure being applied to the process chamber.

The use of the term pressure gradient in the present invention is clearly used in the normal and understood manner, meaning a movement caused by a differential in pressure between two different areas. In other words, the pressure gradient flow of the present invention is caused solely by the difference in pressure between the reactor chamber and the auxiliary chambers without any other force acting thereon.

It is abundantly clear that the flow discussed in Sneh is not due solely to a pressure gradient. Rather, Sneh employs a number of elements to create a desired flow of gas in and out of the process chamber, including booster chambers, a gas distribution chamber, a draw control chamber, a pump and numerous flow restrictors and valves. Nothing in Sneh teaches the specific method of the present invention set forth in claims 11-17 requiring opening and closing of specific valves and allowing the precursor gas to flow solely under a pressure gradient.

In the Advisory Action of 19 January 2006, the Examiner has made further statements concerning his finding regarding gradient pressure. In particular, the Examiner explains that "despite the complexities in the Sneh reference where synchronous modulation of flow and draw takes place, and control elements including valves and flow restrictors are present the underlying driving force for the

flow is based solely on the higher pressure in one area compared to the pressure in another area." The Examiner further argues that "[w]hile the device of Sneh contains valves, pumps, flow restrictors, and synchronous modulation of flow and draw all of these are just means to control the pressure gradient, they are not in anyway another driving force besides a pressure gradient". The Examiner concludes that "one of ordinary skill would recognize that the only driving force for flow in the Sneh reference is the higher pressure upstream in the process compared to the downstream pressure". For the above reasons, the Examiner "asserts that the Sneh reference meets the limitation of 'solely under a pressure gradient' and maintains the rejection".

It is respectfully submitted that the Examiner can not conveniently ignore the invention as disclosed in the present application as well as the direct teachings of the prior art. As noted above, the present invention overcomes at least two distinct disadvantages of prior art ALD processes: i.e. pressure variation that makes uniform deposition impossible, and the significant waste of gas by using flow controllers.

Further, the Examiner's characterization of what one skilled in the art would recognize is simply wrong. Rather, it is abundantly clear that one skilled in the art would recognize that the valves, pumps, flow restrictors, and the flow and draw modulation of Sneh are not done solely for the purpose of controlling pressure gradient. Rather, the Sneh reference is fundamentally the equivalent of the prior art systems mentioned in the present application that attempt to control flow of gas through the use of a variety of components in order to overcome the problem of pressure variations and non-uniform deposition. In particular, it would be much more accurate to describe the Sneh device as a flow controlling mechanism. It should be noted that the Sneh device would suffer from the same disadvantages of other prior art flow control processes, i.e. the significant waste of process gas. To repeat, the Examiner's position regarding the Sneh reference and the characterization of what one skilled in the art would recognize is simply wrong.

In light of the above, it is respectfully submitted that claims 11-17 of the present invention are patentably distinct from Sneh and that Examiner's final rejections of claims 11-20 are not properly founded in law. Therefore, it is respectfully requested that the Board of Appeals so find and reverse the Examiner's final rejections of claims 11-17 under 35 USC 102(e).

Whether claims 18-19 are properly rejected under 35 USC 103(a) as being unpatentable over Satta et al (US Patent No. 6,391,785) in view of Sneh.

Claims 18-19 stand rejected under 35 USC 103(a) as being unpatentable over Satta et al in view of Sneh. These rejections are respectfully traversed and it is respectfully submitted that the present claims are patentably distinct from the references cited.

In the rejection of claims 18-19, the Examiner relies on Sneh for the teachings as set forth in the rejection of claims 11-17. In this light, it has already been shown that Sneh fails to teach or suggest the present invention. Further, the Examiner does not suggest, that Satta et al overcome the deficiencies of Sneh noted above.

Therefore, it is respectfully submitted that claims 18-19 of the present invention are patentably distinct from Satta et al in view of Sneh and it is respectfully requested that the Board of Appeals so find and reverse the Examiner's final rejections of claims 18-19 under 35 USC 103(a).

Whether claim 20 is properly rejected under 35 USC 103(a) as being unpatentable over Sneh as applied to claims 11-17, and further in view of Kang et al (US Patent No. 6,287,965).

Claim 20 is rejected under 35 USC 103(a) as being unpatentable over Sneh in view of Kang. This rejection is respectfully traversed and it is respectfully submitted that claim 20 is patentably distinct from Sneh in view of Kang.

With respect to claim 20, the Examiner again relies on Sneh for the teachings as set forth in the rejection of claims 11-17. In this light, it has already been shown that Sneh fails to teach or suggest the present invention. Further, the Examiner does not suggest, that Kang overcomes the deficiencies of Sneh noted above.

Therefore, it is respectfully submitted that claim 20 is patentably distinct from Sneh in view of Kang and it is respectfully requested that the Board of Appeals so find and reverse the Examiner's final rejections of claim 20 under 35 USC 103(a).

Conclusion

For the reasons noted above, appellants respectfully submit that the Examiner's final rejections of claims 11-20 is not properly founded in law and, therefore, it is respectfully requested that the Board of Appeals so find and reverse all of the Examiner's final rejections.

A copy of the Claims on appeal, i.e. Claims 11-20 is found in the attached appendix. To the extent necessary, Appellants petition for an extension of time under 37 CFR 1.136 by separate letter.

Respectfully submitted,

David A. Hey
Senior Counsel
Registration Number 32,351

Case No. M02A430

CLAIMS APPENDIX

1 - 10. (Withdrawn)

11. A method of delivering precursor gas comprising:

closing a first precursor gas valve located in between a first auxiliary chamber and an inlet of a process reactor chamber,

closing a second precursor gas valve located in between a second auxiliary chamber and an inlet of the process reactor chamber,

reducing the pressure in the process reactor chamber,

opening the first precursor gas valve,

allowing a first precursor gas to flow from the first auxiliary chamber to an inlet of the process reactor chamber solely under a pressure gradient,

closing the first precursor gas valve,

reducing the pressure in the process reactor chamber,

opening the second precursor gas valve,

allowing a second precursor gas to flow from the second auxiliary chamber to an inlet of the process reactor chamber solely under a pressure gradient, and closing the second precursor gas valve

12. A method of delivering precursor gas according to claim 11 further comprising purging the process reactor chamber with an inert gas, and reducing the pressure in the process reactor chamber prior to opening the second precursor gas valve.

13. A method of delivering precursor gas according to claim 12 further comprising purging the process reactor chamber with an inert gas, and reducing the pressure in the process reactor chamber prior to opening the first precursor gas value.

14. A method of delivering precursor gas according to claim 11 wherein the first precursor gas is selected from the group consisting of Zr(OC4H9)4, ZrCl4, HfCl4, Hf(N(CH3)2)4, Hf(N(CH2CH3)2)4, Hf(N(CH3C2H5))4, Y(thd)3, Al(CH3)3, DMAH-EPP, TDMAT, TiCl4, Ti(OCH(CH3)2))4, TaCl5, Ta(OC2H5)5, Sr(C5iPr3H2)2 and Zn (CH2CH3)2.

15. A method of delivering precursor gas according to claim 11 wherein the second precursor gas is selected from the group consisting of NH3, O2, H2O, O3, N2 and H2.

16. A method of delivering precursor gas according to claim 11 further comprising providing a first precursor gas supply coupled to the first auxiliary chamber and a second precursor gas supply coupled to the second auxiliary chamber.

17. A method of delivering precursor gas according to claim 11 further comprising flowing first precursor gas from the first precursor gas supply to the first auxiliary chamber after closing the first precursor gas valve and flowing second precursor gas from the second precursor gas supply to the second auxiliary chamber after closing the second precursor gas valve.

18. A method of delivering precursor gas according to claim 11 wherein the first precursor gas comprises titaniumtetrachloride and the second precursor gas comprises ammonia.

19. A method of delivering precursor gas according to claim 16 wherein the first precursor gas supply comprises titaniumtetrachloride and the second precursor gas supply comprises ammonia.

20. A method of delivering precursor gas according to claim 13 wherein the inert gas is argon.

EVIDENCE APPENDIX

Not Applicable

RELATED PROCEEDINGS APPENDIX

Not Applicable